# I/O Expansion Board for LinPAC-5000 User's Manual

Version 1.0, 2011/09/16

## Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

## Warning

ICP DAS assume no liability for damages consequent to the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, not for any infringements of patents or other rights of third parties resulting from its use.

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# 1. Introduction

## 1.1 What's the I/O Expansion Bus?

The LinPAC-5000 series all support I/O expansion buses. The I/O expansion bus can be used to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory, battery backup SRAM & other I/O functions. Nearly all kinds of I/O functions can be implemented on this bus.

| Model | CPU | Flash | SDRAM | Ethernet | VGA Resolution | USB | I/O Slot | Audio Port |
|-------|-----|-------|-------|----------|----------------|-----|----------|------------|
| LP-5131 | PXA270 520 MHz | 64 MB | 128 MB | 1 | 800 x 600 | 2 | I/O expansion board optional | None |
| LP-5231 | | | | | 1024 x 768 | | | None |
| LP-5331 | | | | | None | | | Yes |
| LP-5431 | | | | | 800 x 600 | | | Yes |
| LP-5531 | | | | | 1024 x 768 | | | Yes |
| LP-5141 | PXA270 520 MHz | 64 MB | 128 MB | 2 | 800 x 600 | 1 | I/O expansion board optional | None |
| LP-5241 | | | | | 1024 x 768 | | | None |
| LP-5341 | | | | | None | | | Yes |
| LP-5441 | | | | | 800 x 600 | | | Yes |
| LP-5541 | | | | | 1024 x 768 | | | Yes |

## 1.2 Library-libxwboard.a

In LinPAC-500 SDK, ICP DAS provides the library file ─ **libxwboard.a** which includes all the functions from the I/O expansion buses which are used in the LinPAC-5000 Embedded Controller.
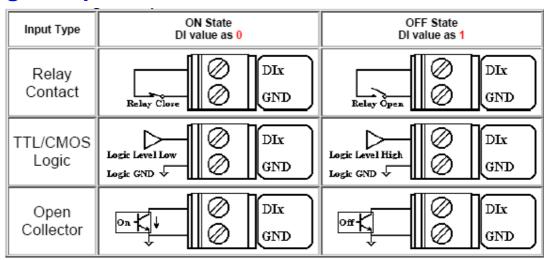
The libxwboard.a is designed specially for the I/O expansion buses on the Linux platform for use in the LinPAC-5000 which can be used to implement various I/O functions. Users can easily develop applications in the LinPAC-5000 by using either C or Java Language.
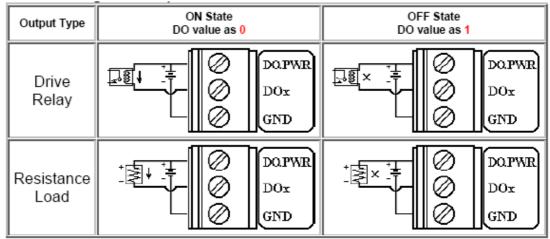
## 1.3 Demo program

Download the demo programs of I/O expansion buses into LinPAC-5000 controller from LinPAC-5000 SDK, all of the demo programs are in C:\cygwin\LinCon8k\examples\xwboard\.
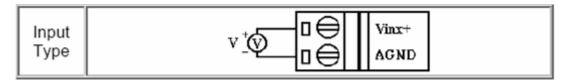
# 2. Wire Connection
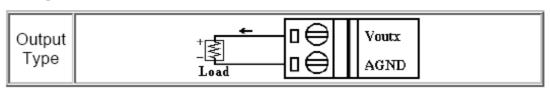
## 2.1 Digital Input Wire Connection

| Input Type | ON State<br>DI value as 0 | OFF State<br>DI value as 1 |
|---|---|---|
| Relay Contact | Relay Close — DIx / GND | Relay Open — DIx / GND |
| TTL/CMOS Logic | Logic Level Low, Logic GND — DIx / GND | Logic Level High, Logic GND — DIx / GND |
| Open Collector | On — DIx / GND | Off — DIx / GND |

## 2.2 Digital Output Wire Connection

| Output Type | ON State<br>DO value as 0 | OFF State<br>DO value as 1 |
|---|---|---|
| Drive Relay | DO.PWR / DOx / GND | DO.PWR / DOx / GND |
| Resistance Load | DO.PWR / DOx / GND | DO.PWR / DOx / GND |

## 2.3 Voltage Input Wire Connection

| Input Type | V + − (V) — Vinx+ / AGND |
|---|---|

## 2.4 Voltage Output Wire Connection

| Output Type | Load + − — Voutx / AGND |
|---|---|

# 3. Expansion Boards

## 3.1 XW-107: DI * 8 + DO * 8

### 3.1.1 Specifications

Digital Input:
- Channels: 8
- Input Type: Dry, Source
- Off Voltage Level: Open
- Off Voltage Level: Connect to GND
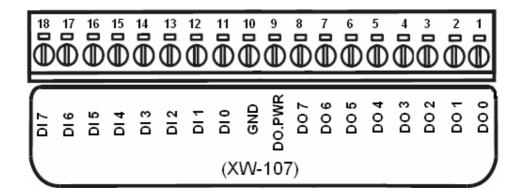- Isolated: none

Digital Output:
- Channels: 8
- Output Type: Sink, Open Collector
- Output Voltage: +10 VCD ~ 40 VCD
- Max. Load Current: 200mA/channel at 25℃
- Isolated: none

### 3.1.2 Pin Assignment

Note: There is no need to use GND and DO.PWR in XW-107(non-isolated).

## 3.1.3 Programming

### ➲ XW107_Init

**Description:**

This function is used to initialize the XW-107.

**Syntax:**

```
                                         [C]
int   XW107_Init()
```

**Parameter:**

None

### ➲ XW107_Read_All_DI

**Description:**

This function is used to obtain all digital input value.

**Syntax:**

```
                                         [C]
int   XW107_Read_All_DI(void)
```

**Parameter:**

None

**Return Value:**

data : 0x00~0xFF

1 : open

0 : close to GND

## ➲ XW107_Read_One_DI

**Description:**

This function is used to obtain each digital input value.

**Syntax:**

[C]
int    XW107_Read_One_DI(int iChannel)

**Parameter:**

iChannel : The digital input channel No.

**Return Value:**

1 : open

0 : close to GND

## ➲ XW107_Write_All_DO

**Description:**

This function is used to set the digital output value for all channel.

**Syntax:**

[C]
void    XW107_Write_All_DO(int iOutValue)

**Parameter:**

iOutValue: The digital output value. Range: 0x00~ 0xFF

**Return Value:**

None

**ICP DAS**

## ➲ XW107_Write_One_DO

**Description:**

This function is used to set the digital output value of the specific digital output channel No. of the XW-107. The output value is only for "0" or "1".

**Syntax:**

```
                                    [C]
void   XW107_Write_One_DO(int iChannel, int iStatus)
```

**Parameter:**

iChannel : The digital output channel No.

iStatus =1 , Status is ON

iStatus =0 , Status is OFF

**Return Value:**

None

## ➲ XW107_Read_All_DO

**Description:**

This function is used to obtain digital output readback All channels.

**Syntax:**

```
                                    [C]
int   XW107_Read_All_DO(void)
```

**Parameter:**

None

**Return Value:**

0x00 ~ 0xFF

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## ➲ XW107_Read_One_DO

**Description:**

This function is used to obtain digital output readback one channels.

**Syntax:**

[C]

int   XW107_Read_One_DO(int iChannel)

**Parameter:**

iChannel : The digital output channel No.

**Return Value:**

1 : ON

0 : OFF

# 3.2 XW-107i: DI * 8 + DO * 8

## 3.2.1 Specifications

Digital Input:
- Channels: 8
- Input Type: Wet Contact (Sink/Source; Default)
- Off Voltage Level: +4 VCD max.
- On Voltage Level: +10 VCD ~50 VCD
- Input Impedance: 10K Ohm
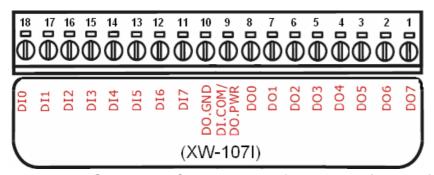- Isolated: 3750 Vrms

Digital Output:
- Channels: 8
- Output Type: Sink, Open Collector
- Output Voltage: +10 VCD ~40 VCD
- Max. Load Current: 200 mA / channel at 25℃
- Isolated: 3750 Vrms

## 3.2.2 Pin Assignment



Note: the GND and DO.PWR is only for XW-107I(isolated).

## 3.2.3 Programming

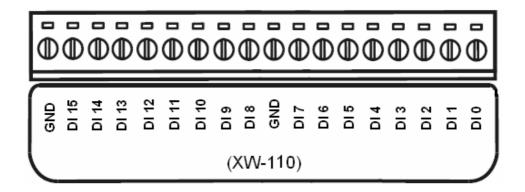Please refer to 3.1.3.

# 3.3 XW-110: DI * 16

## 3.3.1 Specifications

Digital Input:
- Channels: 16

    Input Range/ Type: Logic high level (3.5V~30V)

    Logic low level (0V~1V)
- Isolated: none

## 3.3.2 Pin Assignment



(XW-110)

## 3.3.3 Programming

➲ XW110_Init

**Description:**

This function is used to initialize the XW-110.

**Syntax:**

```
                              [C]
int   XW110_Init()
```

**Parameter:**

None

## ➲ XW110_Read_All_DI

**Description:**

This function is used to obtain all digital input value.

**Syntax:**

[C]
int XW110_Read_All_DI(void)

**Parameter:**

None

**Return Value:**

data : 0x0000~0xffff

1 : open

0 : close to GND

## ➲ XW110_Read_One_DI

**Description:**

This function is used to obtain each digital input value.

**Syntax:**

[C]
int XW110_Read_One_DI(int iChannel)

**Parameter:**

iChannel : The digital input channel No.

**Return Value:**

1 : open

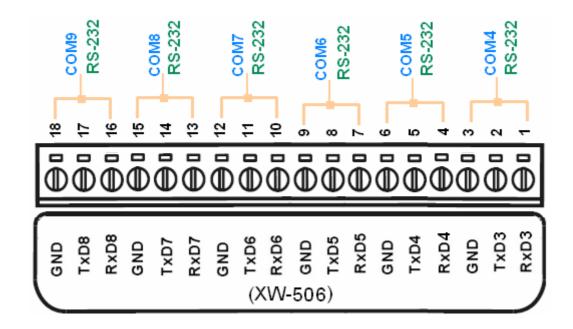0 : close to GND

# 3.4 XW-506: RS-232 * 6

<span style="color:red">~Available soon~</span>

## 3.4.1 Specifications

Parallel I/O:

- RS-232 *6
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: None

## 3.4.2 Pin Assignment



| COM port | Definitions in LP-5K SDK | Device name | Default baudrate |
|----------|--------------------------|-------------|------------------|
| 4 | COM4 | ttyS2 | 9600 |
| 5 | COM5 | ttyS3 | 9600 |
| 6 | COM6 | ttyS4 | 9600 |
| 7 | COM7 | ttyS5 | 9600 |
| 8 | COM8 | ttyS6 | 9600 |
| 9 | COM9 | ttyS7 | 9600 |

# 3.5 XW-507: DI*6 + DO*6 + RS-422/485 * 1
## ~Available soon~

## 3.5.1 Specifications

Digital I/O:

- DI * 6

    Input Range/ Type: Logic high level (3.5V~30V) / Logic low level (0V~1V)

- DO *6

    Open-collector Output: 100 mA / 30V
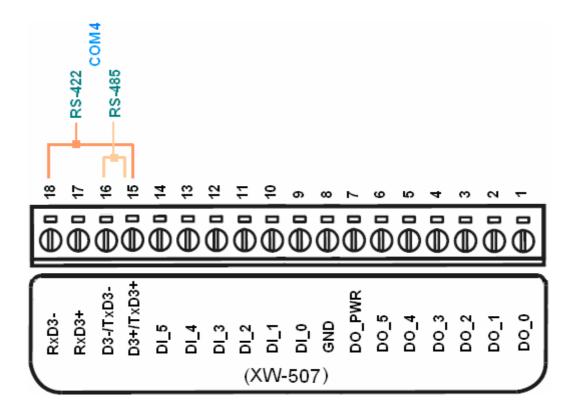
- Isolated: none

Parallel I/O:

- RS-422/485 *1
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: None

## 3.5.2 Pin Assignment



| COM port | Definitions in LP-5K SDK | Device name | Default baudrate |
|----------|--------------------------|-------------|------------------|
| 4 | COM4 | ttyS2 | 9600 |

# 3.5.3 Programming

## ➲ XW507_Init

**Description:**

This function is used to initialize the XW-507.

**Syntax:**

```
                                          [C]
int   XW507_Init()
```

**Parameter:**

None

## ➲ XW507_Read_All_DI

**Description:**

This function is used to obtain all digital input value.

**Syntax:**

```
                                          [C]
int   XW507_Read_All_DI(void)
```

**Parameter:**

None

**Return Value:**

data : 0x0000~0xffff

1 : open

0 : close to GND

## ➲ XW507_Read_One_DI

**Description:**

This function is used to obtain each digital input value.

**Syntax:**

[C]
int   XW507_Read_One_DI(int iChannel)

**Parameter:**

iChannel : The digital input channel No.

**Return Value:**

1 : open

0 : close to GND

## ➲ XW507_Write_All_DO

**Description:**

This function is used to set the digital output value for all channel.

**Syntax:**

[C]
void   XW507_Write_All_DO(int iOutValue)

**Parameter:**

iOutValue: The digital output value. Range: 0x00~ 0xFF

**Return Value:**

None

## ➲ XW507_Write_One_DO

**Description:**

    This function is used to set the digital output value of the specific digital output channel No. of the XW-507. The output value is only for "0" or "1".

**Syntax:**

```
                                    [C]
void   XW507_Write_One_DO(int iChannel, int iStatus)
```

**Parameter:**

    iChannel : The digital output channel No.

    iStatus =1 , Status is ON

    iStatus =0 , Status is OFF

**Return Value:**

    None

## ➲ XW507_Read_All_DO

**Description:**

    This function is used to obtain digital output readback All channels.

**Syntax:**

```
                                    [C]
int   XW507_Read_All_DO(void)
```

**Parameter:**

    None

**Return Value:**

    0x00 ~ 0xFF

# ➲ XW507_Read_One_DO

**Description:**

This function is used to obtain digital output readback one channels.

**Syntax:**

[C]
int    XW507_Read_One_DO(int iChannel)

**Parameter:**

iChannel : The digital output channel No.

**Return Value:**

1 : ON

0 : OFF

# 3.6 XW-508: RS-232 * 8

~Available soon~

## 3.6.1 Specifications

Parallel I/O:

- RS-232 *8
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: None

## 3.6.2 Pin Assignment

# 3.7 XW-509: DI*4 + DO*4 + RS-232* 2
## ~Available soon~

## 3.7.1 Specifications

Digital I/O:

- DI * 4

  Input Range/ Type: Logic high level (3.5V~30V) / Logic low level (0V~1V)
- DI * 4

  Open-collector Output: 100 mA / 30V
- Isolated: none

Parallel I/O:

- RS-232 *2
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: None
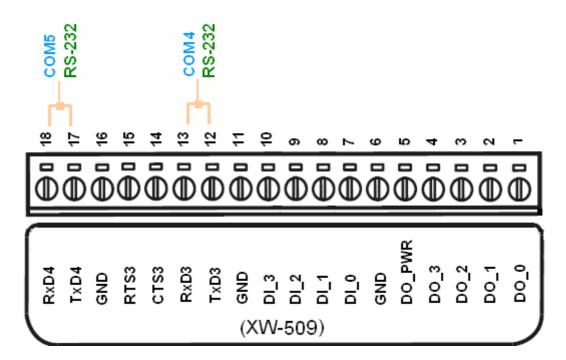
## 3.7.2 Pin Assignment



(XW-509)

| COM port | Definitions in LP-5K SDK | Device name | Default baudrate |
|---|---|---|---|
| 4 | COM4 | ttyS2 | 9600 |
| 5 | COM5 | ttyS3 | 9600 |

# 3.7.3 Programming

## ➲ XW509_Init

**Description:**

This function is used to initialize the XW-509.

**Syntax:**

[C]

int   XW509_init()

**Parameter:**

None

## ➲ XW509_Read_All_DI

**Description:**

This function is used to obtain all digital input value.

**Syntax:**

[C]

int   XW509_Read_All_DI(void)

**Parameter:**

None

**Return Value:**

data : 0x0000~0xffff

1 : open

0 : close to GND

## ➲ XW509_Read_One_DI

**Description:**

This function is used to obtain each digital input value.

**Syntax:**

[C]

int   XW509_Read_One_DI(int iChannel)

**Parameter:**

iChannel : The digital input channel No.

**Return Value:**

1 : open

0 : close to GND

## ➲ XW509_Write_All_DO

**Description:**

This function is used to set the digital output value for all channel.

**Syntax:**

[C]

void   XW509_Write_All_DO(int iOutValue)

**Parameter:**

iOutValue: The digital output value. Range: 0x00~ 0xFF

**Return Value:**

None

# ➲ XW509_Write_One_DO

**Description:**

This function is used to set the digital output value of the specific digital output channel No. of the XW-509. The output value is only for "0" or "1".

**Syntax:**

[C]
void XW509_Write_One_DO(int iChannel, int iStatus)

**Parameter:**

iChannel : The digital output channel No.

iStatus =1 , Status is ON

iStatus =0 , Status is OFF

**Return Value:**

None

# ➲ XW509_Read_All_DO

**Description:**

This function is used to obtain digital output readback All channels.

**Syntax:**

[C]
int XW509_Read_All_DO(void)

**Parameter:**

None

**Return Value:**

0x00 ~ 0xFF

# ➲ XW509_Read_One_DO

**Description:**

This function is used to obtain digital output readback one channels.

**Syntax:**

[C]
int   XW509_Read_One_DO(int iChannel)

**Parameter:**

iChannel : The digital output channel No.

**Return Value:**

1 : ON

0 : OFF

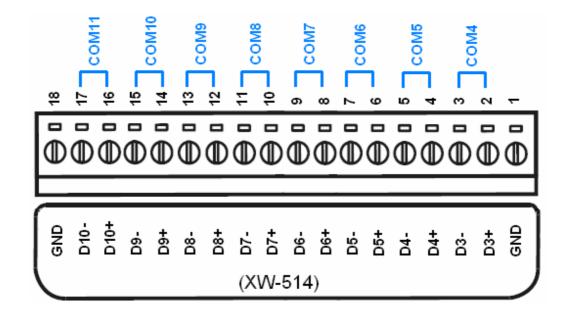# 3.8 XW-511i: RS-485 * 4

## 3.8.1 Specifications

Parallel I/O:

- RS-485 *4
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: Yes
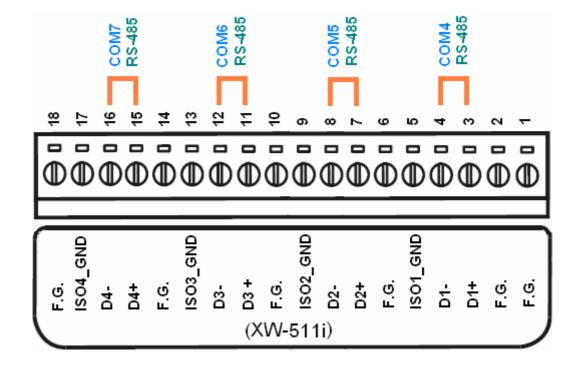
## 3.8.2 Pin Assignment



| COM port | Definitions in LP-5K SDK | Device name | Default baudrate |
|----------|--------------------------|-------------|------------------|
| 4 | COM4 | ttyS2 | 9600 |
| 5 | COM5 | ttyS3 | 9600 |
| 6 | COM6 | ttyS4 | 9600 |
| 7 | COM7 | ttyS5 | 9600 |

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# 3.9 XW-514: RS-485 * 8

## 3.9.1 Specifications

Parallel I/O:
- RS-485 *8
- 16954 compatible
- Internal FIFO: 16 bytes
- Transmission speed: 1152.K BPS max.
- Isolated: None

## 3.9.2 Pin Assignment

| COM port | Definitions in LP-5K SDK | Device name | Default baudrate |
|---|---|---|---|
| 4 | COM4 | ttyS2 | 9600 |
| 5 | COM5 | ttyS3 | 9600 |
| 6 | COM6 | ttyS4 | 9600 |
| 7 | COM7 | ttyS5 | 9600 |
| 8 | COM8 | ttyS6 | 9600 |
| 9 | COM9 | ttyS7 | 9600 |
| 10 | COM10 | ttyS8 | 9600 |
| 11 | COM11 | ttyS9 | 9600 |

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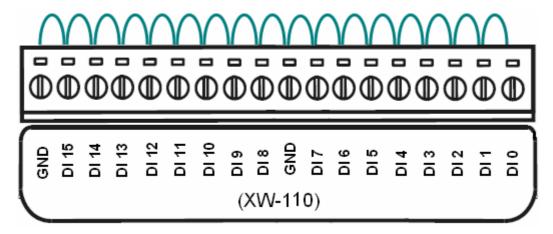
# 4.   Demo for XW-Boards

## 4.1 DI/O Expansion Boards
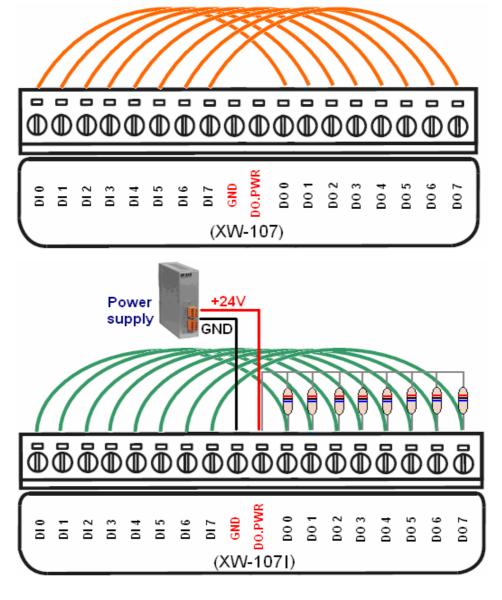
### 4.1.1 DIO

➲ Location

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-1xx\**xw107.c**

➲ Wire Connection

Connect to DI and DO as below:



Note: There is no need to use GND and DO.PWR in XW-107(non-isolated), the GND and DO.PWR is only for XW-107I (isolated).

# ➲ Run

Step1: Download xw107.exe in LinPAC-5000.

Step2: Changes the permission of a file as below:

    # chmod   755   xw107.exe

Step3: Running program.

    # ./xw107.exe

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# 4.1.2 DI

### �➲ **Location**

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-1xx\**xw110.c**

### �➲ Wire Connection

Connect to DI as below:
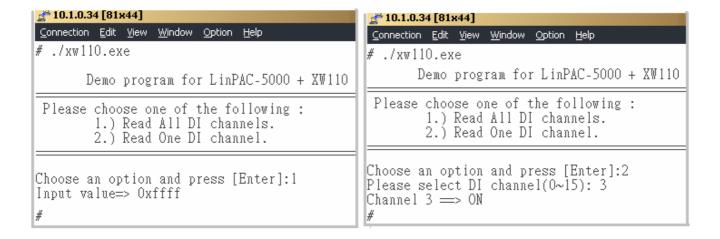


(XW-110)

### �➲ Run

Step1: Download xw110.exe in LinPAC-5000.

Step2: Changes the permission of a file as below:

  # chmod   755   xw110.exe

Step3: Running program.

  # ./xw110.exe



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# 4.2 AI/O, DI/O Expansion Boards
## ~Available soon~

➲ Location

   To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-3xx\


➲ Wire Connection

# 4.3 RS-232/422/485, DI/O Expansion Boards
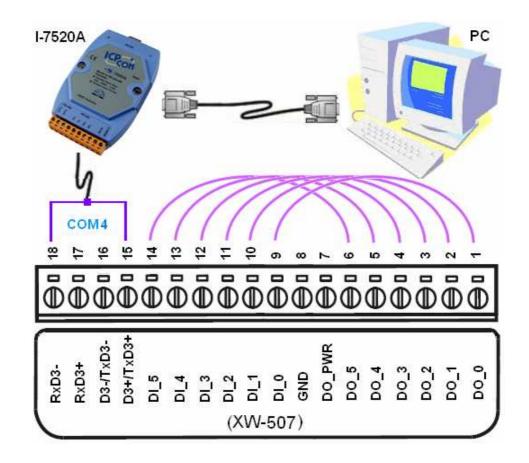
## 4.3.1 RS-422/485, DIO

<span style="color:red">~Available soon~</span>

➲ Location

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-5xx\**xw507.c**

➲ Wire Connection



➲ Run

**Part I**

Step1: Download xw110.exe in LinPAC-5000.

Step2: Changes the permission of a file as below:
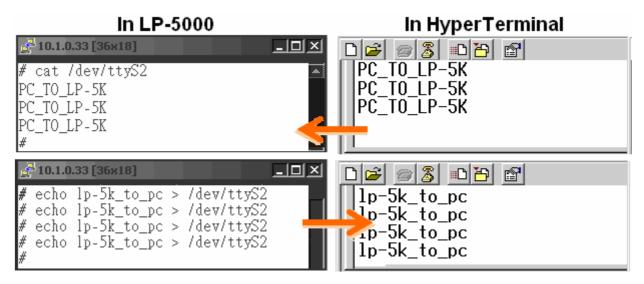
    # chmod   755   xw507.exe

Step3: Running program.
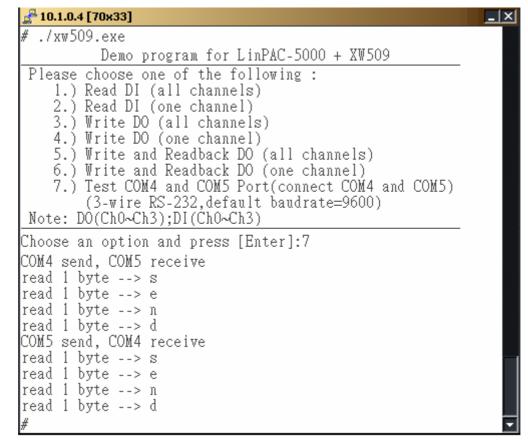
    # ./xw507.exe

## Part II

Step1: Telnet to LinPAC-5000.

Step2: Start HyperTerminal by clicking on '**Start → Programs → Accessories → Communications → Hyper Terminal**'

Step3: In the 'COM properties' dialog box, please set for <u>115200 bits per second, 8 data bits, no parity, 1 stop bit and no flow control</u> to set up the communication parameters for the COM1 port, and press 'OK' when done.

Step4: Send message to the COM4 port from LP-5000 or HyperTerminal respectively.



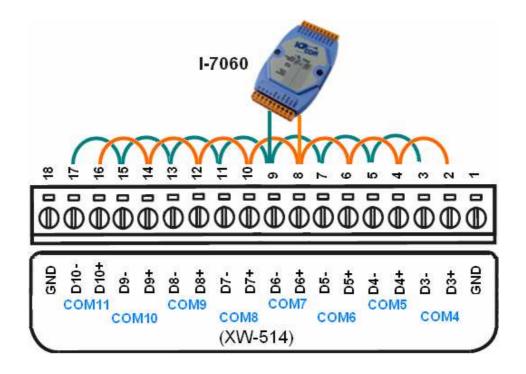**Note**: User can also refer to C:\cygwin\LinCon8k\examples\xwboard\xw-5xx\**xw509.c**
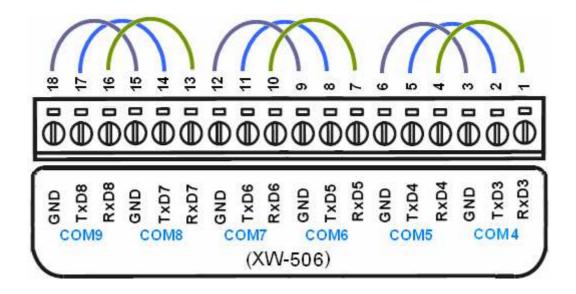
# 4.3.2 RS-232

## ⮑ Location

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-5xx\**sio_port.c**

## ⮑ Wire Connection



## ⮑ Run

Step1: Download sio_port.exe in LinPAC-5000.

Step2: Changes the permission of a file as below:

      # chmod 755 sio_port.exe

Step3: Running program.

      # ./sio_port.exe

Note: The demo is define: COM4 send, COM5 receive

                                COM6 send, COM7 receive

                                COM8 send, COM9 receive

## 4.3.3 RS-485
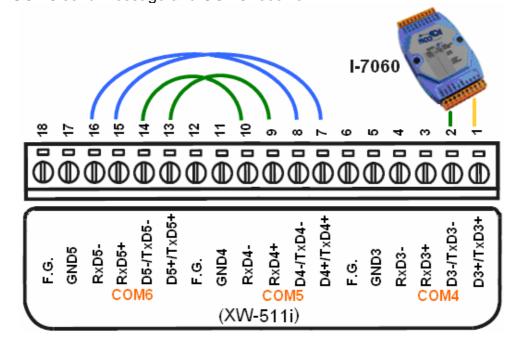
➲ Location

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\xw-5xx\

➲ Wire Connection



(XW-514)

➲ Run

Step1: Using '**getsendreceive**' command to test COM4
Step2: Type " **getsendreceive    0    4    1    '$01M'    9600** " and receive response: **!017060**

## ➲ Location

To install LinPAC-5000 SDK first from LinPAC-5000's CD or FTP site of ICP DAS, and user can refer to C:\cygwin\LinCon8k\examples\xwboard\ xw-5xx\

## ➲ **Wire Connection**

Part1: COM4 connect with I-7060 (Check the I-7060 configuration value is 9600/8/n/1)
Part2: COM5 send message and COM6 receive
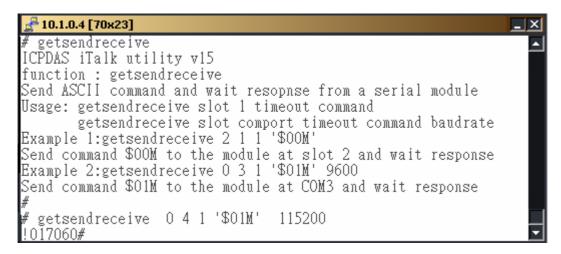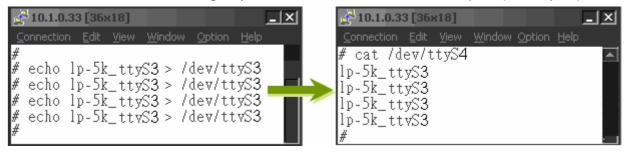Part3: COM6 send message and COM5 receive



## ➲ Run

### Part I

Step1: Using '**getsendreceive**' command to test COM4

Step2: Type " **getsendreceive   0   4   1   '$01M'   9600** " and receive response: **!017060**

## Part II

Step1: Open two Telnet connections (COM5 send, COM6 receive).

Step2: In one of connections, type '**cat   /dev/ttyS4**' for receive message from COM5 port, and another send message by 'echo' command to the COM5 port (/dev/ttyS3).



## Part III

Step1: Open two Telnet connections (COM6 send, COM5 receive).

Step2: In one of connections, type '**cat   /dev/ttyS3**' for receive message from COM6 port, and another send message by 'echo' command to the COM6 port (/dev/ttyS4).